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[Claim(s)]

[Claim 1] The laser building-up approach characterized by using the sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it as a charge of a padding material for building-up processing in carrying out building-up processing of the ingredient with a different characteristic from a work material on the surface of a work material using a laser beam.

[Claim 2] The laser building-up approach according to claim 1 characterized by the rate (void content) that the hole in the unit cross-sectional area of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it occupies being 5 to 50% of range.

[Claim 3] The configuration of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it is a line, rod-like Claim 1 which comes out and is characterized by a certain thing, or the laser building-up approach of a description of two.

[Claim 4] [the component composition of a powder ingredient] Fe, Cu, aluminum, Ti and Si, nickel, Cr, Mn, Co, Mg, B, C, V, Nb, W, Mo, Zr, Ta, the laser building-up approach according to claim 1 to 3 characterized by consisting of one sort or two sorts or more of elements, and an impurity contained unescapable on manufacture among Hf(s).

[Claim 5] The laser building-up approach given in one of the Claims 1-4 characterized by using Nd:YAG laser beam as a laser beam to be used.

[Claim 6] The laser building-up approach according to claim 1 to 5 that the range of width W is characterized by things making it be 0.5xD<=W<=1.0xD when the diameter of the beam in the processing point of a laser beam is set to D and width of a vertical and direction parallel to a work material is set to W to the direction of building up of a sintered body.

[Claim 7] The laser building-up approach according to claim 1 to 6 characterized by making it a

laser beam irradiated by both a work material and the sintered body in a building-up processing point.
[Claim 8] The laser building-up approach according to claim 1 to 7 characterized by things making it the acreage a to which a laser beam irradiates a work material be the range of 0.3xA<=a<=0.7xA when the irradiation surface product of the laser beam in a processing point is set to A.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the suitable laser building-up approach to use for the building-up technique which adds a characteristic which is different from this work material in a work material to that surface.
[0002]
[Description of the Prior Art] In the former, although building-up processing fused the charge of a padding material, and the base material and formed the welding layer, using a frame or the plasma as a heat source, it was common to have made the work material surface weld the powder ingredient which is a charge of a padding material using the heat source of high energy consistencies, such as a laser beam and an electron beam.
[0003]
[Problem to be solved by the invention] Among these, although melting of a work material is small compared with the case where a frame or the plasma is used as a heat source in the case of laser building up, since feed of the powder ingredient which is a charge of a padding material is performed by free fall by the pipe or other guides, For example, there was a problem of not being effective, to building up to the direction contrary to gravity, and three-dimensional processing.
[0004] [laser building-up processing which uses such a powder ingredient] The powder supplied at the time of building-up processing spreads more than the acreage of the laser beam irradiated by the work material, and may be supplied. The powdered yield (the amount of powders consumed by building up to the amount of powders supplied) also had the trouble that it might become low and might be set to one of the causes which raises the cost of components.
[0005] Moreover, although application of the laser building-up technique which made wire rods, such as a filler wire, the charge of a padding material is also performed partly Since the heat capacity of a filler wire is relatively high compared with a powder, face melting a wire, and the energy of a high output is required, and The sake, The penetration to the work material

became large, the keyhole became is easy to be formed, and it had the problem that it was originally inadequate as a means for carrying out the minimum of the melting of a work material.

[0006]

[Objects of the Invention] This invention is made paying attention to the above-mentioned conventional technical problem, and the charge of a padding material can be fused with the heat energy of a lower output compared with the case where wire rods, such as the conventional filler wire, are used. While being able to manage heat energy comparable as laser building-up processing using the conventional powder In using the conventional powder, it makes possible laser building up to the impossible three-dimensional configuration, and it aims at offering the laser building-up approach which uses the sintered body which can realize improvement in productivity, and abatement of component cost as a charge of a padding material.

[0007]

[Means for solving problem] [the laser building-up approach concerning this invention] as indicated to Claim 1 In carrying out building-up processing using a laser beam, an ingredient with a different characteristic from a work material on the surface of a work material as a charge of a padding material for building-up processing It is characterized by using the sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it, and is considered as conventional The means for solving a technical problem which mentioned above the architecture of the laser building-up approach which uses this sintered body.

[0008] And it sets in the embodiment of the laser building-up approach concerning this invention. As indicated to Claim 2, it is characterized by the rate (void content) that the hole in the unit cross-sectional area of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it occupies being 5 to 50% of range.

[0009] Similarly, in the embodiment of the laser building-up approach concerning this invention, as indicated to Claim 3, the configuration of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it is characterized by the line or the rod-like thing [having come out and having considered it as a certain thing].

[0010] In the embodiment of the laser building-up approach concerning this invention similarly As indicated to Claim 4, [the component composition of a powder ingredient] It is characterized by consisting of one sort or two sorts or more of elements, and an impurity contained unescapable on manufacture among Fe, Cu, aluminum, Ti and Si, nickel, Cr, Mn, Co, Mg, B, C, V, Nb, W, Mo, Zr, Ta, and Hf.

[0011] Similarly, in the embodiment of the laser building-up approach concerning this invention, as indicated to Claim 5, it is characterized by using Nd:YAG laser beam as a laser beam to be used.
[0012] In the embodiment of the laser building-up approach concerning this invention similarly As indicated to Claim 6, when the diameter of the beam in the processing point of a laser beam is set to D and width of a vertical and direction parallel to a work material is set to W to the direction of building up of a sintered body, the range of width W is characterized by things making it be 0.5xD<=W<=1.0xD.
[0013] Similarly, in the embodiment of the laser building-up approach concerning this invention, as indicated to Claim 7, it is characterized by what the laser beam was made to irradiate in a building-up processing point by both the work material and the sintered body.
[0014] In the embodiment of the laser building-up approach concerning this invention similarly As indicated to Claim 8, when the irradiation surface product of the laser beam in a processing point is set to A, acreage a to which a laser beam irradiates a work material is characterized by things making it be the range of 0.3xA<=a<=0.7xA.
[0015]
[Function of the Invention] In carrying out building-up processing using a laser beam, the ingredient which has a different characteristic from a work material on the surface of a work material by the laser building-up approach concerning this invention as a charge of a padding material for building-up processing By using the charge of a padding material which consists of such a sintered body, since the sintered body which was mixed with Banda, fabricated the powder ingredient and sintered it was used Building-up processing can be performed by laser heat input almost equivalent to a powder, and impossible three-dimensional building-up processing can be easily performed by the case where the conventional powder is used again.

[0016] It faces using the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it in the laser building-up approach concerning this invention. [that the rate (void content) that the hole in the unit cross-sectional area of a sintered body occupies considers it as the thing of 5 to 50% of range] When most binders evaporate at the time of sintering, a hole is made between powders and a laser beam carries out irregular reflection in the hole between powders at the time of the laser radiation for building-up processing Since it is possible to make high the rate of energy absorption of the charge of a padding material which consists of a sintered body compared with the rate of energy absorption of the charge of a padding material which consists of a filler wire, and powders have not joined together in metallurgy firmly and heat capacity is close to a powder ingredient, building-up processing by less laser heat input can be performed.

[0017] Moreover, it sets to the laser building-up approach concerning this invention. The configuration of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it a line or by [rod-like] coming out and considering it as a certain thing It becomes possible to simplify feeding of the charge of a padding material to a laser building-up processing point. And compared with the case where a powder ingredient is used, there is no breadth of the powder in a processing point again, the accuracy of the amount of charge of the charge of a padding material can be improved, and improvement in the relative alignment accuracy of a laser beam and the charge of a padding material will be aimed at.

[0018] And in the laser building-up approach concerning this invention again [the component composition of a powder ingredient] By consisting of one sort or two sorts or more of elements, and an impurity contained unescapable on manufacture among Fe, Cu, aluminum, Ti and Si, nickel, Cr, Mn, Co, Mg, B, C, V, Nb, W, Mo, Zr, Ta, and Hf A characteristic required for the components to apply can be easily added to a required part.

[0019] Since transmission of the laser beam in an optical fiber can be performed by using Nd:YAG laser beam in the laser building-up approach concerning this invention further again as a laser beam to be used, Combination with a robot etc. can perform laser building-up processing continuously to a more complicated configuration also in three-dimensional processing.

[0020] When the diameter of the beam in the processing point of a laser beam is set to D and width of a vertical and direction parallel to a work material is set to W to the building-up approach of a sintered body in the laser building-up approach concerning this invention further again The range of width W making it be $0.5xD<=W<=1.0xD$ [with things] It will be prevented that the part of the ends of the width of a vertical and direction parallel to a work material serves as non-melting to the direction of building up of a sintered body, and the defect of shape and building-up defect which are generated when the part of the ends of width serves as non-melting can be controlled.

[0021] In the laser building-up approach concerning this invention further again when making it a laser beam irradiated by both a work material and the sintered body in a building-up processing point A work material and the charge of a padding material can be fused simultaneously, and building-up processing can be performed continuously, forming an interface with a work material for a welding layer in a processing point.

[0022] In the laser building-up approach concerning this invention, the acreage a to which a laser beam irradiates a work material further again making it be the range of $0.3xA<=a<=0.7xA$, when the irradiation surface product of the laser beam in a processing point is set to A [things] [a laser beam will be irradiated by only the work material, and the charge of a padding material does not fuse or] While avoiding the condition which is not desirable that

a laser beam is irradiated too much by many charges of a padding material, a work material does not fuse and the interface of a welding layer and a work material is not formed The heat input to the charge of a padding material will increase by irradiation of a laser beam more than needed, and the nonconformity where the part before the charge of a padding material is supplied at a processing point fuses, and normal building-up processing becomes impossible will be controlled.

[0023]

[Effect of the Invention] [according to the laser building-up approach concerning this invention] as indicated to Claim 1 In carrying out building-up processing using a laser beam, an ingredient with a different characteristic from a work material on the surface of a work material as a charge of a padding material for building-up processing By using the charge of a padding material which consists of such a sintered body, since the sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it was used [attain / in the case where building-up processing is attained by laser heat input almost equivalent to a powder, and the conventional powder is used again / impossible three-dimensional building-up processing] The remarkably excellent effectiveness that laser building-up processing to the direction contrary to the gravity made difficult so far is attained is brought about.

[0024] As indicated to Claim 2, when [and] the rate (void content) that the hole in the unit cross-sectional area of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient and sintered it occupies shall be 5 to 50% of range When most binders evaporate at the time of sintering, the hole between powders is made and a laser beam carries out irregular reflection in the hole between powders at the time of the laser radiation for building-up processing Since it is possible to make high the rate of energy absorption of the charge of a padding material which consists of a sintered body compared with the rate of energy absorption of the charge of a padding material which consists of a filler wire, and powders have not joined together in metallurgy firmly and heat capacity is close to a powder ingredient Since building-up processing by less laser heat input is attained, formation of an intermetallic compound can be controlled in the interface of a work material and a welding layer. The outstanding effectiveness that the quality of components or a product can be improved further is brought about, and it is consisting the charge of a padding material of a sintered body further again. Compared with the case where the powder itself is used as a charge of a padding material, large amplification of balling-up of a powder configuration and the setting range of particle size distribution is attained, and the remarkably excellent effectiveness that the manufacturing cost of the charge of a padding material can be reduced is brought about.

[0025] And as indicated to Claim 3, the configuration of the charge of a padding material which consists of a sintered body which was mixed with the binder, fabricated the powder ingredient

and sintered it again a line or by [rod-like] coming out and considering it as a certain thing It becomes possible to simplify feeding of the charge of a padding material to a laser building-up processing point. And compared with the case where a powder ingredient is used, there is no breadth of the powder in a processing point again. [the accuracy of the amount of charge of the charge of a padding material / attain / improvement in the relative alignment accuracy of a laser beam and the charge of a padding material / can improve and] While being able to control birth of defects, such as non-melting of the charge of a padding material by gap of the relative location of a laser beam and the charge of a padding material, and being able to improve the quality of components or a product, the remarkably excellent effectiveness that the product yield can be improved further is brought about.

[0026] Moreover, as indicated to Claim 4, [the component composition of a powder ingredient] By considering it as the becoming thing which consists of one sort or two sorts or more of elements, and an impurity contained unescapable on manufacture among Fe, Cu, aluminum, Ti and Si, nickel, Cr, Mn, Co, Mg, B, C, V, Nb, W, Mo, Zr, Ta, and Hf [a characteristic required for the components to apply / become / to add to a required part easily / it / possible] if characteristics, such as abrasion resistance, can be added to a part of work material, and the whole component is made into the ingredient of a required characteristic or it heat-treats -- etc. -- since a means is not needed, while being able to improve productivity, the remarkably excellent effectiveness that the cost of a product can be held down low is brought about.

[0027] Since transmission of the laser beam in an optical fiber can be performed by using Nd:YAG laser beam further again as a laser beam to be used as indicated to Claim 5, The remarkably excellent effectiveness of becoming possible to perform laser building-up processing continuously to a more complicated configuration also in three-dimensional processing with combination with a robot etc. is brought about.

[0028] As indicated to Claim 6 further again, when the diameter of the beam in the processing point of a laser beam is set to D and width of a vertical and direction parallel to a work material is set to W to the direction of building up of a sintered body The range of width W making it be 0.5xD<=W<=1.0xD [with things] It can prevent that the part of the ends of the width of a vertical and direction parallel to a work material serves as non-melting to the direction of building up of a sintered body, and the remarkably excellent effectiveness of becoming possible to control the defect of shape and building-up defect which are generated when the part of the ends of width serves as non-melting is brought about.

[0029] Further again when making it a laser beam irradiated by both a work material and the sintered body in a building-up processing point as indicated to Claim 7 A work material and the charge of a padding material can be fused simultaneously, and the remarkably excellent effectiveness of becoming possible to perform building-up processing continuously is brought

about, forming the interface of a welding layer and a work material in a processing point.
[0030] As indicated to Claim 8 further again, when the irradiation surface product of the laser beam in a processing point is set to A The acreage a which a laser beam irradiates at a work material making it be the range of 0.3xA<=a<=0.7xA [with things] [a laser beam will be irradiated by only the work material, and the charge of a padding material does not fuse, or] While avoiding the condition which is not desirable that a laser beam is irradiated too much by many charges of a padding material, a work material does not fuse and the interface of a welding layer and a work material is not formed The heat input to the charge of a padding material increases by irradiation of a laser beam more than needed, and the remarkably excellent effectiveness of becoming possible to control the nonconformity where the part before the charge of a padding material is supplied at a processing point fuses, and normal building-up processing becomes impossible is brought about.
[0031]
[Working example] hereafter, although the work example of this invention is explained in detail based on Drawings with a comparative example, this invention may not have not being limited to such a work example, and does not have also until.
[0032] Drawing 1 or 5 shows the production method of the sintered body used as the charge of a padding material used by this invention.
[0033] In this work example, the powder of a cast-iron ingredient component system containing 2weight % of carbon was used. Moreover, the organic binder of a methyl cellulose system was used as a binder.
[0034] Then, first, as shown in drawing 1 , the powder and organic binder of a cast-iron ingredient system were moved from the container 1 into which the powder of a cast-iron ingredient system was put, and the container 2 into which the organic binder of a methyl cellulose system was put in the kneading container 3, respectively. At this time, several kinds were prepared by supplying as that to which the volume mixture ratio of the powder and organic binder of a cast-iron ingredient system was changed. And after the charge, after performing moisture control, within the kneading container 3, it was agitating for about 10 minutes and was considered as the kneading object 4.
[0035] Then, as shown in drawing 2 , pressing was performed by adding the fixed welding pressure P to the kneading object 4 with a plunger 5. Pressing in this case was performed using what made extrusion molding opening of the die 7 the predetermined configuration so that the dimension of the compact 6 after extrusion molding might be set to width 2:mm, thickness:1mm, and (die-length:1000mm), as shown in drawing 2 .
[0036] Subsequently, while installing in the heating furnace 8 which shows drawing 3 the compact 6 by which pressing was carried out, performing heat at a heater 9 and flying a binder thoroughly between temperature up, the cylindrical sintered body 10 shown in drawing 4 and

drawing 5 was obtained by sintering at 1100 degrees C for 1 hour.

[0037] Although the cross section of the sintered body after sintering was shown in drawing 5 , as shown in drawing 5 , the sintered body 10 from which the area ratio (void content) of the hole 11 per unit area in the cross section of a sintered body 10 differs was prepared in some numbers at this time.

[0038] Subsequently, as shown in drawing 6 , laser building up was carried out, using the above-mentioned sintered body as a charge of a padding material. On the occasion of this laser building up, Nd:YAG laser (thing of 5kW of maximum output) was used for the laser transmitter, and the diameter D of the laser beam 13 in the processing point to the work material 12 was set as 2mm. And the sintered body (charge of a padding material) 10 was supplied towards the processing point from the include angle of 45 degrees, when we decided to supply using the sintered-body feeder 14 and the surface include angle of the work material 12 was made into 0 times. Moreover, the speed of supply of the sintered body 10 was made into 1.6 m/min. And working speed formed the welding layer 15 in the surface of the work material 12 as carrying out by 1 m/min being constant again.

[0039] When laser building up is performed in drawing 7 using a sintered body as a charge of a padding material which is one of this invention work examples, The mimetic diagram of a result which observed the minimum laser output from which a normal welding layer is obtained about the case where laser building up is performed as a charge of a padding material which is the conventional technique using a powder and a filler wire, and the cross section of the welding layer 15 obtained after laser building-up processing is shown. At this time, building up formed the welding layer 15 by performing building-up processing in the shape of a straight line on the work material 12 which consists of common structural rolled steel (SS400) of 4mm of board thickness. Moreover, the powder amount of supply and the filler wire amount of supply in the conventional technique set up processing feeding conditions, and were performed so that it may become almost equivalent to the building-up configuration of the sintered body in the example of this invention.

[0040] The minimum laser output from which the normal welding layer 15 at the time of using a powder among the example of this invention and the conventional technique is obtained was 1.5kW, and was 4kW in the case where a filler wire is used among the conventional techniques so that more clearly than drawing 7 . Moreover, the keyhole 16 was formed when a filler wire was used.

[0041] This result shows that building-up processing by a laser output almost equivalent to laser building up which uses a powder among the conventional techniques is possible in laser building up which uses a sintered body. Moreover, compared with the case where a filler wire is used, it has the outstanding description that a keyhole (16) is hard to be formed.

[0042] The work example and comparative example of this invention are shown in Table 1.

[0043] At this time, building-up processing conditions presupposed that it is the same as that of the above, and considered the processing output as 2.5kW regularity. And the diameter D of a beam in the processing point of a work material changed the width W of a 2mm sintered body [in / it supposes that it is fixed and / a direction vertical to the direction of building up], and the beam irradiation acreage a to the sintered body, and was performed. And assessment after building-up processing was considered as the cross section of a welding layer, and organic-functions assessment of the appearance again.

[0044]

[Table 1]

区 分	空孔率 (%)	ビーム径 D (mm)	焼結体の幅 W (mm)	ビーム面積 A (mm²)	肉盛材料ビーム照射面積 a (mm²)	断面、外観評価
実施例 1	40	2	2	2×π 6.3	(2×π)×0.5 3.15	良好
実施例 2	5	2	1	2×π 6.3	(2×π)×0.3 1.9	良好
実施例 3	10	2	1.5	2×π 6.3	(2×π)×0.4 2.5	良好
実施例 4	30	2	1.5	2×π 6.3	(2×π)×0.6 3.8	良好
実施例 5	50	2	1.5	2×π 6.3	(2×π)×0.7 4.4	良好
比較例 1	3	2	2	2×π 6.3	(2×π)×0.5 3.15	溶融せず
比較例 2	55	2	2	2×π 6.3	(2×π)×0.5 3.15	焼結体供給中破損
比較例 3	1	2	2	2×π 6.3	(2×π)×0.5 3.15	溶融せず
比較例 4	65	2	2	2×π 6.3	(2×π)×0.5 3.15	焼結体供給中破損
比較例 5	40	2	0.5	2×π 6.3	(2×π)×0.5 3.15	被加工材溶融大
比較例 6	40	2	2.5	2×π 6.3	(2×π)×0.5 3.15	肉盛層未溶着部有
比較例 7	40	2	3	2×π 6.3	(2×π)×0.5 3.15	肉盛層未溶着部有
比較例 8	40	2	2	2×π 6.3	(2×π)×0.2 1.3	被加工材過剰溶融
比較例 9	40	2	2	2×π 6.3	(2×π)×0.1 0.6	被加工材過剰溶融
比較例10	40	2	2	2×π 6.3	(2×π)×0.8 5.0	焼結体加工前溶融
比較例11	40	2	2	2×π 6.3	(2×π)×0.9 5.7	焼結体加工前溶融

[0045] As shown in Table 1, in work examples 1-5, the problem was not looked at by a welding layer and melting of a work material, and interface formation, but the good welding layer was obtained.

[0046] On the other hand, when the void content of a sintered body was low and irradiated a

laser beam in comparative examples 1 and 3 at a sintered body, since there was little irregular reflection of the laser beam inside a sintered body, the heat input to a sintered body was lacking, and the 2.5kW laser output of melting of the sintered body was inadequate as the result.

[0047] Moreover, in comparative examples 2 and 4, since what has the high void content of a sintered body was used, it became weak, and while feeding the sintered body at the processing point, it damaged, and the result inadequate for performing continuous building-up processing was obtained.

[0048] Furthermore, in the comparative example 5, although the width of the sintered body was small to the diameter of a beam and a sintered body can fully be fused, melting of the work material may have been large, the amount of formation of the intermetallic compound of an interface may have increased depending on the combination of an ingredient, and it may have become the cause of defective birth, such as a crack.

[0049] In comparative examples 6 and 7, to the diameter of a beam, the width of the sintered body may have been large and the defect which a sintered body does not fuse enough in the ends of a vertical direction to the direction of building up of a welding layer in which it did not weld may have occurred further again.

[0050] By comparative examples 8 and 9, since the beam acreage in a processing point was irradiated more mostly [a work material] than a sintered body, since the work material fused superfluously, the intermetallic compound was formed in the interface depending on the combination of the charge of a padding material, and a work material, and there was a possibility of leading to defective birth of a crack etc. further again. Moreover, since a sintered body may not fully fuse depending on processing conditions, it was not desirable.

[0051] Since the beam acreage in a processing point is mostly irradiated to the direction of a sintered body by comparative examples 10 and 11 further again, While the part before becoming small, the heat input to a sintered body becoming superfluous and melting of a work material being supplied to a processing point by the heat conduction of a sintered body fuses and a normal welding layer may not be obtained Since there was little melting of workability, there was possibility that formation of an interface would not be made, and it was not desirable.

[0052] Since it was such, by the laser building-up approach which uses the sintered body of the specification specified in this invention as a charge of a padding material, it has proved that it was possible to perform good building-up processing, and it excelled in productivity, and lifting of cost could be suppressed again.

[Brief Description of the Drawings]

[Drawing 1] It is the cross-sectional explanatory view showing signs that a cast-iron ingredient system powder and an organic binder are kneaded in the work example of this invention.

[Drawing 2] It is the cross-sectional explanatory view showing signs that extrusion molding is carried out in the work example of this invention.

[Drawing 3] It is the cross-sectional explanatory view showing signs that an extrusion molding object is sintered in the work example of this invention.

[Drawing 4] It is the slant-face explanatory view of the sintered body obtained in the work example of this invention.

[Drawing 5] It is the amplification explanatory view of the sintered body obtained in the work example of this invention.

[Drawing 6] It is the cross-sectional explanatory view showing signs that laser building-up processing is performed using the charge of a padding material which consists of a sintered body in the work example of this invention.

[Drawing 7] It is the explanatory view showing the cross-sectional configuration of the minimum laser output from which a normal welding layer is obtained in the example of this invention, and the conventional technical example, and the obtained welding layer.

[Explanations of letters or numerals]

6 Extrusion Molding Object

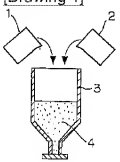
10 Sintered Body (Charge of Padding Material)

12 Work Material

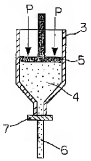
13 Laser Beam

15 Welding Layer

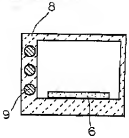
[Drawing 1]



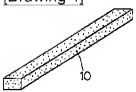
[Drawing 2]



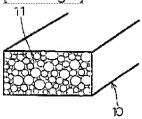
[Drawing 3]



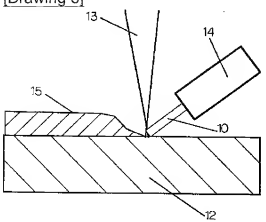
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Drawing 7]

肉盛材料の種類	本発明 (焼結体を使用したレーザ肉盛)	従来技術 (粉末を使用したレーザ肉盛)	従来技術 (ワイヤを使用したレーザ肉盛)
正常な肉盛層が得られる最小レーザ出力	1.5 kW以上	1.5 kW以上	4.0 kW以上
得られた肉盛層および母材の断面			

[Translation done.]